INSULATOR DEPARTMENT
GENERAL ELECTRIC COMPANY

April 3, 1964

RADIO INTERFERENCE FROM E. H. V.
TRANSMISSION LINES AND SUBSTATIONS

ML-9, Tabs L and N

As most of you are by now already aware, the subject of radio noise generated by conductors and insulator assemblies on E. H. V. transmission lines has been one which has been very controversial for some two or three years and there has undoubtedly been a tendency to go way overboard by many utility and consulting engineering organizations in the specification of very severe corona and radio influence voltage requirements on insulator assemblies of all kinds.

This undoubtedly has arisen from the fear that E. H. V. lines may produce tremendous amount of radio interference and thus be a cause of poor public relations between the utility and people living in areas adjacent to or near E. H. V. transmission lines.

The relationship between radio influence voltage on insulator components measured in the laboratory on a directly coupled basis to the radio field intensity which these devices would produce on the line has not been well understood in the past and it now appears that radio noise suppression on insulator assemblies and components has in most cases been greatly overemphasized far beyond the actual needs.

At the inception of E. H. V. work in the early years after World War II, with the almost complete lack of knowledge and understanding about these things, the concept was that insulator assemblies should never show any visible or audible corona at a voltage at least 10% above line to neutral voltage and that the R. I. V. on the components as measured in the laboratory should be held at 50 to 100 microvolts or lower when the assembly was energized at 110% of line to ground voltage. This has resulted in a lot of costly designs with all components made with either large and bulky radii at the edges or else has involved rather complete and thorough shielding.

More recently, these R. I. V. specifications for insulator assemblies for E. H. V. projects have been somewhat liberalized where specifications have permitted the R. I. V. levels to go to 350 to 500 microvolts at voltages applied equal to 110% of the maximum line to ground operating voltage.

It now becomes apparent that these liberalized specifications are requiring much better performance radio interference wise than is actually needed, which is causing the cost of insulator assemblies to be higher than is necessary for the actual performance of the line.

In the final analysis, the utility building an E. H. V. circuit is concerned with what the radio interference field is at the edge of the transmission line right-of-way, usually 100 to 150 ft. from the centerline of the transmission circuit.

The main generator of radio interference on a transmission line, under the best of conditions is the conductor which extends continuously throughout every foot of the transmission line. As a practical matter, it is virtually impossible to get this conductor into place with no mars or scratches on its surface and even if they did, insects, air borne particles, dirt, etc., will give rise to radio interference almost continuously along the transmission circuit.

Insulator assemblies are dispersed along the line at perhaps one assembly per phase every 1,000 to 1,200 ft. and these become discrete noise sources infrequently interposed on top of the noise sources which the conductors themselves produce.

The ultimate result of this is that within reason it matters very little what the magnitude of the noise is arising from the insulator assemblies, their effect will generally be swamped by the hundreds of thousands of noise generators arising in connection with the conductor. Work done on project E. H. V. and other experimental high voltage projects, as well as experience with actual operating E. H. V. transmission lines is now beginning to show that a great deal of undue emphasis has been put in the past on the question of radio noise generation of insulator assemblies and components.

In many discussions over the past two or three years with utilities, I have tried to reflect this type of attitude and have been suggesting to the utility engineers not to set their R. I. requirements for insulator assemblies too low, suggesting that by doing so, they are increasing the cost of these assemblies without obtaining any improvement in overall performance in their lines in this respect. For lack of any authoritative backing in this, this urging has to a large extent gone unheeded.

For the past several years, the Transmission and Distribution Committee of I. E. E. E. has had a Radio Noise Sub-Committee which has been investigating and discussing this subject. This Sub-Committee has been broken up into several working groups and Working Group No. 4, headed by Mr. T. W. Liao, of the General Electric Company, has been studying the problem of radio noise generation from line and station components.

As of March 10, 1964, Mr. Liao's Working Group on this subject has issued a tentative report which is, I think, very illuminating, and which comments on many phases of the whole situation. The work of this group has reviewed the results of many experimental transmission line investigations as well as the performance of various E. H. V. lines now in service and their findings certainly confirm the recommendations which we have been making, only in general, they would go considerably further than anything we had ventured to propose so far. For your information, I am attaching a copy of this tentative Working Group's report. Please bear in mind that this report is not yet official; it has not been adopted by the Radio Noise Sub-Committee, nor by the I. E. E. E. Transmission and Distribution Committee. However, it does reflect the thinking of the group of individuals in the industry who are most conversant to the whole situation and shows the trend of thinking among the experts on this subject. I commend this report highly for your thorough study and hope that you will grasp its full importance.

There is no reason why this document cannot be shown to utility customers who are interested in this subject provided that they thoroughly understand that it is a tentative report of the Working Group reflecting their best thoughts on the subject in view of their intimate knowledge of it. It should be borne in mind that this report may not be accepted in its entirety by either the Radio Noise Sub-Committee or the Transmission and Distribution Committee after these bodies have had a chance to thoroughly digest it. However, it is quite likely that it will not be greatly modified.

To summarize the situation, for lack of knowledge and understanding on this subject, most of the E. H. V. transmission lines which have been built so far, have undoubtedly gone to unnecessary lengths in the suppression of corona and radio influence voltage on insulator assemblies. Research work in the field which has been done on experimental transmission lines such as the Penelec 500 kv Project, the E. H. V. Project, the Apple Grove Project, the Public Service of Colorado High Altitude Project, etc., is now beginning to turn in results to show the way toward sensible specification for R. I. V. performance of insulator assemblies and components.

The chart shown in Figure 2 of this report gives quite definite recommendations for the specification of R. I. V. performance for insulator and hardware assemblies for transmission lines of all voltages and you notice, for instance, that at 500 kv they have recommended a limitation of 2,000 microvolts R. I. V. as measured in the laboratory at 110% of the normal line to ground maximum operating voltage. Liberalization of specifications for insulator assemblies to this degree could result in a marked reduction in the cost of such assemblies.

R. L. McCoy

lr

att.